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Effect of adding L-Arginine in growth traits and and body dimensions for male Awassi lambs

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Abstract

The current study was conducted at Agricultural Research station, Agriculture College, Al-Muthanna University, from 10/10/2023 to 10/3/2024, to discover the possibility of using L-Arginine, T1(control treatment) at concentrations of 0.5 gm / kg feed for the second treatment T2 and 1 gm / kg feed for the third treatment T3 and 1.5 gm / kg feed for the fourth treatment T4. Its effect on the productive characteristics and body dimensions of Awassi sheep lambs. As 16 male Awassi sheep lambs at the age of 4 months were used in the study. The study showed significant differences between the experimental treatments (P≤ 0.05) on the (body weight, weekly weight gain), and (body length, Breast circumference, abdominal circumference, front height and back height). The results showed that treatment T4 was superior to the rest of the treatments followed by treatments T3 and T2 (a rate of 1 gm/kg feed) and (adding arginine at a rate of 0.5 gm/kg feed) respectively and all treatments were superior to treatment T1 in the values of production traits.

Key words: productive, body dimensions, Awassi male lambs, L-Arginine.

Introduction

Animal production is one of the important components and foundations in supporting the pillars of wealth and the global and local economy. It was noted that many of the world's population depends on agricultural wealth to earn their livelihood, and their number is 2.96 billion people. This number contributes directly to the

value of food production by about 25%. Animal production provides many contributions to support the economy and animal wealth, such as providing fertilizers and basic materials in many different industries[1] .

The additives that are added and mixed with animal feed, whether ruminant or domesticated, in livestock production projects, with the aim of improving the animal's efficiency, increasing its production, improving its physical and health condition and enhancing it to resist diseases and achieve maximum production with minimal losses [2],[3]stated when studying the importance of feed additives in Holstein Friesian calves, that real food additives are the most commonly used additives, include essential compounds in the animal's body and are necessary to maintain its daily natural activities and for building and growth, including animal fats, vegetable oils and amino acids, can be manufactured from methionine, lysine, minerals, rare minerals and vitamins.

Arginine is an essential amino acid with the structural formula ($CH_4N_4O_2$) [4] [5]. Arginine is naturally found in lupins, succulents, lactic acid bacteria, soybeans, beef, and animal horns [6]. [7]indicated that arginine is an essential amino acid in small mammals and that arginine deficiency in the diet may affect milk performance during lactation, limiting the growth and development of newborns and growth data in goats. Arginine plays a critical role in postnatal development and is responsible for maximal growth in small mammals [8].

The body produces arginine through the urea cycle in the kidneys from citrulline, made from ornithine and carbamoyl phosphate in the liver, but the amount of arginine produced is not sufficient for the body to perform important activities during development and growth [9]. The diets of small mammals must be supplemented and enhanced with additional food sources to achieve maximum growth rates [10]. [11] have shown that when arginine enters the body, it forms nitric oxide gas (Nitric NO), which is an important relaxing factor in the lining of the alveoli and blood vessels. Citrulline deficiency in mammals leads to the formation of arginine during the urea cycle, which forms orotic acid, which is excreted in urine. If citrate is present, this indicates a deficiency of arginine in the diet of small animals and mammals [12].

The present study aims to demonstrate the importance of adding different levels of the amino acid L-Arginine on the productive

performance and body dimensions of Awassi male lambs.

Material and methods

The current experiment was carried out in the animal production field of the first agricultural research and experiment station, College of Agriculture, Al-Muthanna University, located in the Umm Al-Akf area (12 km) southwest of Samawah, to detect the effect of adding L-Arginin to the feed to show some productive characteristics and body dimensions of male Awassi lambs, from 10/10/2023 to 10/3/2024, in the current study, 16 male lambs aged 4-6 months were used, randomly distributed into four treatments, they were clinically examined during the preliminary period, which lasted for 14 days in order to acclimatize them and ensure their safety and freedom from diseases, after which the lambs were entered into the experiment, it was divided into four groups as follows:

T1: included 4 male lambs aged 4-6 fed on a diet devoid of additives and was considered as a control group.

T2: included 4 male lambs aged 4-6 months fed on a diet to which arginine was added 0.5 gm per 1 kg of feed.

T3: included 4 male lambs aged 4-6 months fed on a diet to which arginine was added 1 gm per 1 kg of feed.

T4: included 4 male lambs aged 4-6 fed on a diet to which arginine was added 1.5 gm per 1 kg of feed.

L-Arginine used in the current study was obtained in different concentrations by bringing and purchasing it from outside the country and of Indian origin and brand (CDH). It was in sealed packages and in the form of powder. It was weighed in a sensitive balance and the different proportions were calculated for each treatment of the experimental treatments used in this study (0.5, 1, 1.5) gm per 1 kg of feed in the graduate studies laboratory in the Department of Animal Production, College of Agriculture, Al-Muthanna University. It was then mixed with the lamb rations for the experimental groups and treatments at different concentrations.

Animal weights and weight gain: Animal weights were recorded at the beginning of the experiment as initial weight after a three-week preparatory period, then the weight was recorded weekly during the experiment, using a special electronic scale with a capacity of 300 kg, made in Turkey. Weight gain was also measured, the weight gain of the animals was calculated every two weeks using the following equation:

Weight gain = second weight - first weight.

The following body measurements and dimensions were observed and recorded [13]:

Breast circumference: The chest circumference was measured using a regular measuring tape directly after the shoulder blade.

Abdominal circumference: The abdominal circumference was measured from the front of the hind legs using a regular measuring tape.

Front height: The fore-end height was measured at the shoulder using a measuring tape after the animal was standing normally. The fore-end height was recorded by placing the tape vertically at the level of the animal's feet and ending at the top of the shoulder.

Back height: The measurements were taken by placing the measuring tape vertically at the level of the animal's hind legs (after the animal was stable and standing in the normal position) and

ending at the top of the animal's hindquarters (pelvic area).

Body length: It was measured for lambs from the beginning of the shoulder blade bone to the end of the pelvic bone along the body.

Results and Discussion

Table (1) shows the effect of adding arginine on the weekly body weight rate (kg) of Awassi sheep lambs, it was noted that there are no significant differences between all treatments during the beginning of the experiment from the second week until the sixth week of the experiment, as for the eighth week until the twelfth week of the experiment, the table indicates a significant increase (P≤0.05) in T4 (adding 1.5 gm arginine/kg feed) followed by T3 (adding 1 gm arginine/kg feed) then T2 (adding 0.5 g arginine/kg feed) compared to T1 (control treatment). The final body weight rate reached 27.49, 29.35, 30.97 and 32.88 kg for T1, T2, T3 and T4, respectively.

Table (1) The effect of adding arginine to the feed on the weekly body weight rate of Awassi sheep lambs (mean ± standard error).

Treatments	Age (weeks)					
	2	4	6	8	10	12
T1	19.40±.430	20.67±.440	22.12±.450	23.94±.450 b	25.99±.440 b	0.43±27.49 b
T2	20.38±.450	22.72±.450	24.23±.440	26.00±.410 b	±27.23.390 b	0.39±29.35 b
T3	20.84±.330	22.27±.330	24.84±.320	26.07±.320 a b	28.90±.320 a	0.32±30.97 a
T4	21.82± 0.43	23.42±.440	25.17±.430	27.46±.430 b	29.88±.430 a	0.47±32.88 a
Level of Seg	N.S	N.S	N.S	*	*	*

Table (2) shows the current results of weight gain in Awassi sheep lambs. There were significant differences at the level of P≤0.05 between the experimental treatments. There was a significant superiority in the weight gain of lambs in all treatments. It was noted at the beginning of the experiment from the second week until the sixth week that there were no significant differences in all treatments. As for the eighth week until the twelfth week of the experiment, the table indicates a significant increase (P≤0.05) in T4, followed by T3 and T2 compared to T1 (control treatment).

The final total weight gain rate reached 8.40, 9.80, 10.40 and 11.87 kg for T1, T2, T3 and T4, respectively.

Table (2) The effect of adding arginine to the feed on the weekly and total weight gain of Awassi sheep lambs (mean ± standard error).

Treatments	Age (weeks)						Total
	2	4	6	8	10	12	
T1	±1.150.09	1.47±0.02	1.50±0.37	1.55 ±0.31 a	1.63±0.21 b	1.97±0.22 c	8.40±0.71 b
T2	1.52±0.35	1.56±0.25	1.55±0.43	1.67±0.19 b	1.88±0.14 b	2.25±0.28 b	9.80±0.27 b
T3	1.57±0.34	1.60±0.06	1.65±0.25	1.85±0.20 a	1.95±0.24 b	2.95±0.53 b	10.40±0.51 ab
T4	1.60±0.39	1.66±0.23	1.77±0.42	1.92±0.19 a	2.12±0.23 a	3.40±0.07 a	11.87±0.87 a
Level of Seg	N.S	N.S	N.S	*	*	*	*

The reason for the superiority of the body weight rate and the final total weight gain in the study weeks may be attributed to two reasons, one of which is the growth rate and natural weight gain with age and study weeks. The other is the effect of arginine, which is a protein substance and amino acids that enter into the composition of all hormones and components of the living body. It stimulates the development of building and muscle growth and stimulates the growth hormone to perform its work in building and weight gain of Awassi sheep lambs. These results are consistent with what was reached by [14] who showed that the weight gain of the body is clear with age in the true mountain gazelle. It forms Nitric oxide (NO) is an important relaxing factor in the lining of the alveoli and blood vessels. Citrulline deficiency also leads to the formation of arginine during the urea cycle, which leads to its accumulation and the formation of orotic acid, which is important in muscle building and growth [11]. Arginine and ornithine produced by arginine and the activation of the nervous system can produce growth hormone and insulin-like growth factor, which, when increased, leads to an increase in the weight of newborns after birth [15]. Nitric oxide, a metabolic by-product of arginine, also leads to the release of GHRH in mammals and directly stimulates the pituitary gland to release growth hormone and causes a significant increase in its levels, which enhances the growth and maturation of muscle tissue and leads to an increase in body weight and vitality [12].

The results of the body measurements and dimensions in the Awassi sheep lambs used in the current experiment, included the body length, abdominal circumference, chest circumference, fore-hatch height and hind-hatch height (Tables 3, 4, 5, 6 and 7). The results showed significant differences (P≤0.05) between the values and body dimensions studied and all the experimental treatments under the influence of adding arginine.

The current results of measuring the body length in Table (3) showed significant differences represented by a significant increase (P≤0.05) in the body length measurement rate (cm) between all treatments in the experiment starting from the second week until the last weeks of the experiment, while the differences did not appear in the first week from the beginning of the experiment, as this increase in body length dimensions is consistent with the weight gain that occurred in the body in the last weeks of the current experiment.

Table (3) The effect of adding arginine to the feed on the weekly body length rate of Awassi sheep lambs (mean ± standard error).

Treatments	Age (weeks)					
	2	4	6	8	10	12
T1	69.90±1.88	71.00±1.29 d	73.00±1.08 d	75.75±1.43 d	80.00±1.35 d	87.50±1.32 d
T2	70.30±1.65	72.75±1.88 c	74.75±1.97 c	77.75±1.97 c	82.00± 1.77 c	90.00±1.47 c
T3	70.90±1.04	73.82±0.25 b	75.29±0.25 b	80.25±0.94 b	88.75±1.43 b	97.00±1.29 b
T4	71.80±2.62	75.25±2.56 a	82.25±2.49 a	88.75±2.52 a	2.17±94.50 a	104.50±0.64 a
Level of Seg	N.S	*	*	*	*	*

Table (4) shows the effect of adding arginine on measuring the weekly abdominal circumference (cm) of Awassi sheep lambs, there were no significant differences between all treatments during the beginning of the experiment and in the second and fourth weeks of the experiment. As for the sixth week to the end of the experiment, the table indicates a significant increase (P≤0.05) and the superiority of T4, followed by T3 and then T2 compared to T1 (control treatment).

Table (4) The effect of adding arginine to the feed on measuring the weekly abdominal circumference of Awassi sheep lambs (mean ± standard error).

Treatments	Age (weeks)					
	2	4	6	8	10	12
T1	86.75± 0.47 ab	88.75± 0.47 ab	90.50±0.64 d	93.00±1.08 d	101.25±0.85 d	107.25±0.85 d
T2	88.00±0.40 a	90.00±0.40 a	93.25± 0.62 c	99.50±0.64 c	106.50±0.64 c	110.50±0.64 c
T3	87.25±0.85 ab	91.50±0.64 b	96.50±0.28 b	103.75±0.47 b	110.50± 0.64 b	119.00±0.40 b
T4	85.25±1.31 a	92.25±0.94 ab	99.00±0.40 a	106.50±0.64 a	114.50±0.64 a	126.50±0.64 a
Level of Seg	N.S	N.S	*	*	*	*

Table (5) shows the effect of adding arginine on measuring the weekly chest circumference (cm) of Awassi sheep lambs, there were no significant differences between all treatments during the beginning of the experiment, the second and fourth weeks of the experiment. As for the sixth week of the experiment, we note from the table that there was a significant increase (P≤0.05) in T4 (120.50), followed by T3 (114.20) then T2 (107.75), compared to the first treatment (control) which gave the lowest value of (102.50).

Table (5) The effect of adding arginine to the feed on the weekly chest circumference measurement of Awassi sheep lambs (mean ± standard error).

Treatments	Age (weeks)					
	2	4	6	8	10	12
T1	82.00±1.35	84.25±1.31 d	90.50±0.86 d	95.00±0.91 d	99.00±0.91 d	102.50± 0.64 d
T2	±85.501.65	86.50±2.17 c	93.50±2.53 c	98.75±3.40 c	102.50±0.64 c	107.75±0.85 c
T3	86.75±1.03	88.00±1.47 b	95.00±1.47 b	100.50±1.50 b	105.50±1.55 b	114.20±0.40 b
T4	88.00±2.58	91.75±1.93 a	97.25±1.75 a	104.50±1.55 a	111.50±1.19 a	120.50± 0.64 a
Level of Seg	N.S	*	*	*	*	*

As for measuring the height of the front, the results in Table (6) showed no significant differences in the height of the front at the beginning of the experiment in the second week, while the differences began to appear in the fourth week and until the end of the experiment in the twelfth week between all treatments, which gave a significant increase (P<0.05) in T4 (94.25), followed by treatments T3, T2, T1, which gave 86.75, 80.25, 76.50 in succession, which is superior when compared with the control group.

Table (6) The effect of adding arginine to the feed on measuring the weekly front height of Awassi sheep lambs (mean ± standard error).

Treatments	Age (weeks)					
	2	4	6	8	10	12
T1	0.47±59.25	0.25±61.47 d	0.50±63.50 d	0.40±69.40 d	0.64±72.50 d	0.64±76.50 d
T2	1.19±60.50	1.32±63.50 c	1.47 ±65.20 c	1.77±72.30 c	1.79 ±76.25 c	1.79±80.25 c
T3	61.75±0.62	65.50±0.50 b	68.75±0.47 b	75.50±0.95 b	80.55±0.35 b	86.75±1.10 b
T4	0.75±63.45	0.91±67.00 a	1.10±72.75 a	0.91±78.60 a	0.62±86.25 a	0.62±94.25 a
Level of Seg	N.S	*	*	*	*	*

As for measuring the height of the back, we note from the results of Table (7) that there was no significant difference in the height of the back at the beginning of the experiment in the second week, while the differences began to appear in the fourth week and until the end of the experiment in the twelfth week between all treatments, as T4 gave the highest value of (90.70) T2, T3 (83.50 and 75.50) in succession compared to T1 (control) which gave the lowest value of (72.25).

Table (7) The effect of adding arginine to the feed on measuring the weekly buttock height of Awassi sheep lambs (mean ± standard error).

Treatments	Age (weeks)					
	2	4	6	8	10	12
T1	58.50 ±0.64	60.75±0.85 b	65.75±0.85 b	67.75±0.85 c	70.50±0.86 d	72.25±0.85 d
T2	60.50±0.50	61.75±0.62 b	66.75±0.62 b	70.50±0.28 c	73.50±0.64 c	75.50±0.64 c
T3	60.60±0.40	63.50±0.28 a	69.70±0.40 a	74.66±0.40 b	78.50±0.64 b	83.50±0.64 b
T4	62.40±0.62	66.75±1.79 ab	73.25±1.13 a	78.50±1.70 a	84.50±1.19 a	90.70±0.47 a
Level of Seg	N.S	*	*	*	*	*

The results for all studied traits showed that T4 (adding arginine at a rate of 1.5 gm per kg of feed) was superior to the rest of the other treatments and the control group, and that this superiority was due to the joint and synergistic effect of adding arginine with the feed. Arginine is produced in the body during the urea cycle in the kidneys from citrulline made from ornithine and carbamoyl phosphate in the liver, but its produced quantity is not sufficient, so it needs to be enhanced with feed additives so that the body can perform important activities during development and growth [6],

or that arginine and ornithine produced by arginine added to the feed and activating the nervous system can produce growth hormone and insulin-like growth factor, which when increased leads to an increase in the weight of newborns after birth and an increase in the measurements and dimensions of the lambs' bodies [15].

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